

The Boeing Company  
P.O. Box 516  
St. Louis, MO 63166-0516  
(314) 232-0232

RCAP-RECEIVED

DEC 16 2011

December 14, 2011  
107A-6635-JWH

Ms. Christine Kump-Mitchell, P.E.  
Environmental Engineer, Permits Section  
Missouri Department of Natural Resources  
Hazardous Waste Program  
7545 South Lindbergh  
St. Louis, MO 63125



RE: Boeing Tract I (MOD000818963) Corrective Action

Encl: Interim measures Work Plan Sub-Areas 2B and 6B, The Boeing Company,  
Tract I, Hazelwood, Missouri

Dear Ms. Kump-Mitchell:

The enclosed work plan for your review and comments describes the proposed interim measures discussed with you previously. The work plan will be referenced in the corrective measures study to be submitted in January.

Please contact me if you have any questions.

Sincerely,

A handwritten signature in dark ink, appearing to read "Joe Haake", written over a light-colored background.

Joe Haake  
Environmental Scientist  
(314)777-9181

cc: Rich Nussbaum, MDNR  
Bruce Stuart, MDNR  
Amber Whisnant, U.S. EPA, Region 7

RCRA



516853

**Interim Measures Work Plan Sub-areas 2B and 6B  
The Boeing Company, Tract 1  
Hazelwood, Missouri**



*Prepared for:*  
**The Boeing Company  
Environment, Health and Safety  
Boeing Defense, Space & Security  
P.O. Box 516, MC S111-2491  
St. Louis, MO 63166-0516**

*Prepared by:*  
**RAM Group of Gannett Fleming, Inc.  
5433 Westheimer Road, Suite 725  
Houston, TX 77056  
Ph: (713) 784-5151  
Fax: (713) 784-6105  
e-mail: [asalhotra@ramgp.com](mailto:asalhotra@ramgp.com)**

**December 2011**

RCAP-RECEIVED  
DEC 16 2011

## TABLE OF CONTENTS

	<u>Page</u>
TABLE OF CONTENTS	i
LIST OF TABLES	ii
LIST OF FIGURES	ii
ABBREVIATIONS	iii
<b>1.0 OBJECTIVE .....</b>	<b>1-1</b>
1.1 BACKGROUND AND INTRODUCTION .....	1-1
<b>2.0 BACKGROUND INFORMATION .....</b>	<b>2-1</b>
2.1 SUB-AREA 2B.....	2-1
2.1.1 Description.....	2-1
2.1.2 Interim Actions Completed.....	2-1
2.1.3 Site Stratigraphy and Site Hydrology .....	2-1
2.1.4 Soil Concentrations.....	2-2
2.1.5 Groundwater Concentrations .....	2-2
2.1.6 Evaluation of Groundwater.....	2-2
2.1.6.1 Shallow Groundwater Zone .....	2-2
2.1.6.2 Deep Groundwater Zone.....	2-3
2.2 SUB-AREA 6B.....	2-4
2.2.1 Location and Activities.....	2-4
2.2.2 Interim Actions Completed.....	2-4
2.2.2.1 HRC Injection at MW-3.....	2-4
2.2.2.2 Soil Excavation .....	2-4
2.2.3 Site Stratigraphy and Site Hydrology .....	2-5
2.2.4 Soil Concentrations.....	2-5
2.2.5 Groundwater Concentrations .....	2-5
2.2.5.1 Shallow Groundwater Zone .....	2-5
2.2.5.2 Deep Groundwater Zone.....	2-6
<b>3.0 PROPOSED ACTIVITIES .....</b>	<b>3-1</b>
3.1 TASK 1: INITIAL CHEMICAL INJECTION ACTIVITIES .....	3-1
3.1.1 Sub-area 2B.....	3-1
3.1.2 Sub-area 6B.....	3-2
3.2 TASK 2: MONITORING TO EVALUATE EFFECTIVENESS.....	3-2
3.2.1 Sub-area 2B.....	3-2
3.2.2 Sub-area 6B.....	3-2
3.3 TASK 3: ADDITIONAL INJECTION OF CHEMICALS .....	3-3
3.3.1 Sub-Area 2B.....	3-3
3.3.2 Sub-area 6B.....	3-3

3.4	TASK 4: ANALYSIS OF DATA AND RECOMMENDATIONS.....	3-3
3.5	TASK 5: REGULATORY INTERACTION .....	3-3
<b>4.0</b>	<b>SCHEDULE AND DELIVERABLES.....</b>	<b>4-1</b>
4.1	SCHEDULE.....	4-1
4.2	DELIVERABLES.....	4-1
<b>5.0</b>	<b>REFERENCES.....</b>	<b>5-1</b>

---

#### LIST OF TABLES

Table 2-1	Chlorinated Solvent Soil Concentrations for SWMU 17 Area (µg/kg)
Table 2-2	Chlorinated Solvent Groundwater Data for SWMU 17 Area
Table 2-3	Soil Data for Sub-area 6B (North)

---

#### LIST OF FIGURES

Figure 1-1	Risk Assessment Exposure Area Map
Figure 2-1	SWMU 17 Data Points
Figure 2-2(a)	Shallow Zone Groundwater Contour Map (June 15 – 17, 2011)
Figure 2-2(b)	Deep Zone Groundwater Contour Map (June 15 – 17, 2011)
Figure 2-3(a)	Overview of Sub-area 2B
Figure 2-3(b)	Historical Sampling Locations in Sub-area 2B
Figure 2-4	Sub-area 6B Data Points
Figure 3-1	Proposed Monitoring Well Locations in Sub-area 2B
Figure 3-2	Proposed Monitoring Well Locations in Sub-area 6B

## ABBREVIATIONS

---

CMS	Corrective Measures Study
cm/sec	Centimeters per Second
COC	Chemical of Concern
DCE	Dichloroethene
DO	Dissolved Oxygen
ft bgs	Feet Below Ground Surface
HRC	Hydrogen Release Compound
ISCO	In-Situ Chemical Oxidation
MDNR	Missouri Department of Natural Resources
µg/kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
ORP	Oxidation Reduction Potential
PCE	Tetrachloroethene
PID	Photoionization Detector
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
TCE	Trichloroethene

## **1.1 BACKGROUND AND INTRODUCTION**

This document refers to the remediation of localized chlorinated solvent impacts in two source areas referred to as the Sub-areas 2B and 6B in the risk assessment report (RAM, 2004). Refer to Figure 1-1 for the locations of these two areas. The objective of this effort is to evaluate whether groundwater concentrations of chlorinated solvents in these two source areas could be further reduced with a small-scale injection program. The proposed effort is effectively a continuation of the previously implemented interim remediation measures in these two areas.

This work plan is organized as follows:

- Section 1.0 presents the overall objective of this effort.
- Section 2.0 presents relevant background information for each of the two areas.
- Section 3.0 presents the specific tasks that will be accomplished as a part of the interim remedial activities.
- Section 4.0 presents the schedule for accomplishing these tasks.

The previously completed remedial investigations, several subsequent monitoring events, and preliminary modeling results have all indicated that although the chlorinated solvent impacts in the two Sub-areas have been present for several years in soil and groundwater, there is no evidence of migration beyond the immediate source area. This is likely due the combination of silty clay sediments; tight soils and low hydraulic gradient; and the on-going natural attenuation of the solvents. Further, the site-wide risk assessment indicated that the only unacceptable risk in these two areas was potential dermal contact with tetrachloroethene (PCE) (Sub-area 2B) and trichloroethene (TCE) (Sub-area 6B). These risks can readily be managed using institutional controls.

Boeing voluntarily and with the concurrence of Missouri Department of Natural Resources (MDNR), intends to further supplement the previously completed interim remedial measures in these two areas. The intent is to evaluate the opportunity to proactively reduce the concentrations of chlorinated solvents and the daughter products in these two areas. Although no specific remedial target levels are presented here, these will be developed as a part of the corrective measures study (CMS).

For both sub-areas, in-situ chemical oxidation (ISCO) would be evaluated to destroy the mass of chlorinated solvents in soil and groundwater and to reduce the groundwater concentrations.

## SECTION 2.0

### BACKGROUND INFORMATION

---

This section presents a brief relevant background of the two Sub-areas. Specifically, the section focuses on a description of the localized source areas, geology and hydrogeology, the interim measures conducted to date. For additional information refer to the site-specific references included in Section 5.

#### 2.1 SUB-AREA 2B

##### 2.1.1 Description

The Sub-area 2B was used for PCE recovery using a distillation unit. Handling of the liquid PCE resulted in spillage of PCE liquids. The primary chemicals of concern (COCs) are the chlorinated solvents and their daughter products and include:

- PCE,
- TCE,
- cis-1,2-Dichloroethene (DCE),
- trans-1,2-DCE, and
- Vinyl chloride.

##### 2.1.2 Interim Actions Completed

The interim remedial actions (MACTEC, 2006) completed previously included the excavation and off-site disposal of 2,073 tons of impacted soil. The excavated area was about 100 ft east-west by 40 ft north-south by 10 ft deep. Figure 2-1 shows the area excavated and the sampling locations. Three piezometers and a monitoring well (TP-1, TP-2, B5111, and MW-7S) were removed during the excavation but not replaced. A 4-inch diameter stainless steel well screen was placed in the southeast corner of the excavation to a depth of 11.75 ft to act as a backfill observation well (SWMU17-OB-1).

Hydrogen release compound (HRC) was added to the floor of the excavation prior to backfilling with clean fill to assist in the bio-dechlorination of the COCs.

##### 2.1.3 Site Stratigraphy and Site Hydrology

Based on approximately 73 soil borings drilled in this area, the stratigraphy consists of:

0 to 1.5 ft bgs	Surface cover - asphalt, concrete, gravel, and/or rock base
1 to 17 ft bgs	Silty clay and fill soil
11 to 49.5 ft bgs	Clay
49.5 to 53.5 ft bgs	Weathered limestone rubble and clay
53.5 to 54 ft bgs	Clay
54 to 75 ft bgs	Clay and weathered shale

The average depth to groundwater was 5.8 feet below ground surface (ft bgs) and ranged from 4.5 ft bgs to 6.8 ft bgs. The shallow zone groundwater flow direction was generally to the southeast with a gradient of about 0.03 ft/ft (refer to Figure 2-2(a)). From the *Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report for McDonnell Douglas, Hazelwood, Missouri* (MACTEC, 2004a), assuming a hydraulic conductivity of  $3.8 \times 10^{-5}$  centimeters per second (cm/sec) and a porosity of 10%, the average groundwater seepage velocity is 4.2 ft/year.

The average water depth in the intermediate wells was 8.6 ft bgs and ranged from 6.7 ft bgs to 12.9 ft bgs. In the deep well, MW-11D, the water depth was 22.2 ft bgs and the deep zone groundwater flow was to the south (Figure 2-2(b)).

#### 2.1.4 Soil Concentrations

Table 2-1 lists all the chlorinated solvent soil concentration data available from the portion not removed during interim action. The soil results indicate there are:

1. Residual localized impacts below the limits of the excavation; and
2. Impacts on the walls of the excavation, i.e. residual soil impacts exist beyond the extent of excavation.

#### 2.1.5 Groundwater Concentrations

Table 2-2 lists the chlorinated solvent groundwater concentrations from 36 shallow wells, three intermediate wells, one deep well, and one backfill well. The samples were collected from 1998 to 2011. These wells are shown on Figures 2-3(a) and 2-3(b).

#### 2.1.6 Evaluation of Groundwater

##### 2.1.6.1 Shallow Groundwater Zone

The extent of elevated chlorinated solvent impacts has been identified and is confined to an area within about 100 ft of the excavated area, as defined by:

Well ID	Present/Absent	Distance/Direction from Excavated Area	# of Times Sampled (years)
MW-7S	absent	within	8 (2001-2005)
SB18	absent	within	1 (2000)
TP-1	absent	within	2 (1998-2001)
TP-2	absent	within	9 (1998-2005)
TP-4	present	25 ft/south; cross to down gradient	10 (1998-2008)

TP-5	absent	within	4 (2000-2001)
TP-8	absent	55 ft/south; down gradient	1 (2001)
TP-9	absent	50 ft/south; down gradient	1 (2001)
TP-10	absent	45 ft/west; cross to up gradient	1 (2001)
TP-11	absent	35 ft/east; down gradient	1 (2001)
TP-14	absent	35 ft/north; cross gradient	1 (2001)
TP-15	absent	95 ft/southeast, down gradient	1 (2001)
TP-16	absent	65 ft/east; cross to down gradient	1 (2001)
TP-17	absent	15 ft/north; up gradient	1 (2001)
TP-21	absent	60 ft/south; down gradient	1 (2001)
TP-22	absent	60 ft/southwest; cross to down gradient	1 (2001)
TP-23	absent	75 ft/southwest; cross to up gradient	1(2001)

Of the above listed groundwater sampling points, only TP-4 still remains. Groundwater concentrations show a decreasing trend since 2003. All the other sampling points were removed, some during the excavation.

#### 2.1.6.2 Deep Groundwater Zone

The deep groundwater zone has four monitoring wells in Sub-area 2B (MW-5I, MW-8I, MW-11I, and MW-11D). The intermediate wells identified with "I" are screened in the upper portion of the deep groundwater zone and the deep well (MW-11D) is screened in the lower portion of the deep groundwater zone. The extent of chlorinated solvent impacts has been identified for it does not extend to the down gradient wells, MW-11I and MW-11D located about 210 ft to the east of MW-5I.

There is a potential hot spot in the vicinity of monitoring well MW-5I; however, it is limited in extent based on the following:

- MW-5I is located about 30 ft east of the excavated area in a down to cross gradient location.
- Both MW-11I and MW-11D located about 140 ft east of the excavated area in a down to cross gradient location have been non-detectable during most sampling events since 2001.

Thus, although the spatial extent of the highly impacted area is not defined, it is anticipated to be about 40 feet by 40 feet.

## **2.2 SUB-AREA 6B**

### **2.2.1 Location and Activities**

Figure 2-4 shows the Sub-area 6B and the location of the monitoring points. This area is used as the scrap metal recycling dock area and has been used for recycling and accumulating scrap metal since 1954. Prior to the 1980s, this area was used for drum storage. The primary chemicals of concern are chlorinated solvents and their daughter products:

- PCE,
- TCE,
- cis-1,2- DCE,
- trans-1,2-DCE, and
- Vinyl chloride.

### **2.2.2 Interim Actions Completed**

Two interim actions were performed in this area consisting of HRC injection and soil excavation.

#### **2.2.2.1 HRC Injection at MW3**

A pilot test in Sub-area 6B consisted of the injection of HRC on July 19, 2002 in nine borings around MW3 and follow-up monitoring in MW3, MW3A (25 ft upgradient), and MW3B (25 ft downgradient). The monitoring results provided definitive evidence of accelerated reductive dechlorination. The dechlorination process was observed to go to completion with the reduction of TCE to cis-1,2-DCE to vinyl chloride to ethene to ethane through 2003 (MACTEC, 2004b). However, subsequent sampling indicated that cis-1,2-DCE and trans-1,2-DCE concentrations in MW3 have increased and vinyl chloride concentrations in MW3 have remained stable possibly due to insufficient HRC.

#### **2.2.2.2 Soil Excavation**

The soil excavation was completed in September 2005 and 56 tons of excavated soils were disposed off-site (MACTEC, 2006). The excavated area (refer to Figure 2-4), was at the northwest corner of the dock in the area where piezometers RC2 and RC9 were previously located. The excavated area was about 15 ft east-west by 15 ft north-south by 6 ft deep. Five soil samples were collected for laboratory analysis from the limits of the excavation, one from each wall and one from the floor. The excavation was filled with clean limestone rock and crushed limestone and compacted in lifts. The surface concrete was replaced to match the existing surface.

Piezometers RC13 and RC14 were installed adjacent to the excavation in July 2005 (prior to the

excavation activities). RC15 was installed within the excavated area after completion of the excavation activities in September 2005.

### 2.2.3 Site Stratigraphy and Hydrogeology

Based on the approximately 20 borings the stratigraphy generally consists of:

1 to 3 ft bgs	Surface cover - asphalt, concrete, gravel base, fill soils, top soil, silt
1 to 49 ft bgs	Silty clay, clay, silt
49 to 55 ft bgs	Clay
55 to 56 ft bgs	Sandy gravel
56 to 68 ft bgs	Silty clay
68 to 69 ft bgs	Sand
69 to 70 ft bgs	Silty Clay
70 to 74 ft bgs	Limestone bedrock

The average depth to groundwater was 5.7 ft bgs and ranged from 2.6 ft bgs to 8.4 ft bgs. The flow direction was generally to the east with a gradient of about 0.003 ft/ft (refer to Figure 2-2(a)). From the *RFI Report* (MACTEC, 2004a), assuming a hydraulic conductivity of  $3.8 \times 10^{-5}$  cm/sec and a porosity of 10%, the average groundwater seepage velocity is 36 cm/year (1.2 ft/year).

The average water depth in the deep well (MW9D) was 1.1 ft bgs and ranged from 0.4 ft bgs to 1.5 ft bgs; however, since 2008 this well has been artesian with groundwater flowing from the well when the well cap is removed. MW9D was abandoned in March 2011.

### 2.2.4 Soil Concentrations

Table 2-3 lists all the chlorinated solvent soil concentrations in the portions not excavated. The soil concentrations indicate there are:

- Localized low-level impacts (4.6 micrograms per kilogram ( $\mu\text{g/kg}$ ) vinyl chloride) below the limits of the excavation, and
- Low-level impacts ( $<1.2 \mu\text{g/kg}$  to  $36 \mu\text{g/kg}$  vinyl chloride) on the walls of the excavation.

### 2.2.4 Groundwater Concentrations

#### 2.2.5.1 Shallow Groundwater Zone

Since 2008, an increase in the cis-1,2-DCE concentrations has been observed in MW3.

Evaluation of the shallow groundwater zone impacts indicates a localized hot spot in the vicinity of the MW3. This localized hot spot is limited in extent based on the following well results:

Well ID	Present/Absent	Distance/Direction from MW3	# of Times Sampled (years)
MW3	present	within	23 (2000-2010)
MW3A	present	25 ft/west; up gradient	14 (2002-2004)
RC1*	absent	70 ft/northwest; up gradient	1 (2000)
RC2*	absent	80 ft/north; cross gradient	1 (2000)
RC3*	absent	105 ft/south; cross gradient	1 (2000)
RC4*	absent	185 ft/west-northwest; up gradient	1 (2000)
RC6S*	absent	140 ft/south-southeast; cross gradient	1 (2000)
RC8S*	absent	50 ft/north-northeast; cross to down gradient	1 (2000)
RC8D	present	55 ft/north-northeast; cross to down gradient	6 (2000-2008)
RC10*	absent	225 ft/west; up gradient	1 (2000)
RC14	present	70 ft/north-northwest; cross gradient	4 (2005-2008)

\*: Sampling points abandoned.

#### 2.2.5.2 Deep Groundwater Zon

The deep groundwater zone has not been impacted based on the 11 sampling events at MW9D from 2000 to 2003. MW9D was abandoned in March 2011, since it could not be sampled due to artesian conditions since 2008.

## SECTION 3.0 PROPOSED ACTIVITIES

---

The section presents the proposed interim remediation activities in each of the two areas, namely Sub-area 2B and Sub-area 6B. Although the specific details are different in each area, generically the following activities are proposed:

1. A limited Geoprobe investigation to collect baseline soil and groundwater samples to confirm the current vertical and horizontal extent of constituents in the shallow groundwater zone. This task may also include the injection of oxidants in known areas of impact;
2. Installation of permanent shallow zone wells based on the Geoprobe investigation;
3. Installation of intermediate zone monitoring wells;
4. Area-wide injection of chemicals;
5. Groundwater monitoring to evaluate the relative benefits of further in situ remediation;
6. Evaluation of monitoring data and recommendations; and
7. Regulatory interaction.

Each of these activities is described below.

### 3.1 TASK 1: INITIAL CHEMICAL INJECTION ACTIVITIES

The activities for each of the sub-areas are described below. In each area, initial activities will be conducted in two phases. Phase 1 will involve geoprobe investigation up to a depth of about 25 ft. Phase 2 will consist of the evaluation of the data collected in Phase 1 and the installation of permanent monitoring wells. Limited oxidant injections will also be conducted in known areas of impact during Phase 1.

#### 3.1.1 Sub-area 2B

**Phase 1:** Geoprobe borings will be installed up to a depth of 25 ft bgs and laterally at 20 ft intervals from SWMU 17 in each direction. These borings will enable the sampling of current concentrations in soil and shallow groundwater. Soil samples will be collected based on visual observations, odors, and elevated photoionization detector (PID) readings. In the previously excavated area, soil samples will not be collected at depths above 10 ft bgs since the native soil was excavated and the area was backfilled with clean crushed limestone rock. Groundwater samples will be collected using Geoprobe, SP16 Groundwater Sampler or temporary monitoring wells, and using either a peristaltic pump or a bailer. The borings will be installed in each direction until no further evidence of potential impacts is observed.

HRC was placed at the bottom of the previously excavated area and groundwater data since this treatment is not available to determine the current conditions directly below the excavated area. Therefore, chemical injection, if necessary, will be based on the results of the Phase 1 investigation. However, there is evidence of current impacts at MW-5I. Initial chemical injection for ISCO will be performed at MW-5I.

**Phase 2:** Figure 3-1 shows the preliminary locations of the permanent monitoring wells. The exact location and number of permanent shallow and deep monitoring wells will be modified based on the results of the Phase 1 investigation.

### **3.1.2 Sub-area 6B**

Similar to Sub-area 2B, the activities in Sub-area 6B will be performed in two phases.

**Phase 1:** Geoprobe borings will be installed up to a depth of 25 ft bgs and laterally at 10 ft intervals from MW3 in each direction to confirm the impacts in soil and groundwater in this area. Soil samples will be collected based on visual observations, odors, and elevated PID readings. Groundwater samples will be collected using Geoprobe, SP16 Groundwater Sampler or temporary monitoring wells, and using either a peristaltic pump or a bailer.

Four borings will be cored near MW3 and MW3A to inject oxidants between a depth of 5 and 25 feet.

**Phase 2:** Figure 3-2 shows the preliminary locations of the permanent monitoring wells. The exact locations and number of permanent shallow monitoring wells will be determined based on the results of the Phase 1 investigation.

Currently groundwater data are not available for the deep groundwater zone in the MW3 area. A deep zone monitoring well will be installed near MW3.

The temporary monitoring well (B27W3D) is a 0.5-inch diameter well and the groundwater recharge is very low for collection of a representative sample. The concentration of total DCE is 391 µg/L and vinyl chloride is 1,100 µg/L. Therefore a permanent monitoring well will be installed at this location to collect representative groundwater samples.

## **3.2 TASK 2: MONITORING TO EVALUATE EFFECTIVENESS**

To assess the effectiveness of the first chemical injections, groundwater samples will be collected from select wells in Sub-areas 2B and 6B. The activities of this task for each of the sub-areas are described below.

### **3.2.1 Sub-area 2B**

Samples will be collected from well MW-5I and the injection wells approximately 1 month and 2 months after the first chemical injection is completed. All samples will be analyzed for chlorinated solvents and water quality parameters (pH, oxidation reduction potential [ORP] and dissolved oxygen [DO]). The analytical results of the groundwater samples will be used to evaluate the effectiveness of the first round of chemical injections.

### **3.2.2 Sub-area 6B**

Samples will be collected from wells MW3, MW3A, MW3B, and the injection wells

approximately 1 month and 2 months after the first chemical injections are completed. All samples will be analyzed for chlorinated solvents and water quality parameters (pH, ORP and DO). The analytical results of the groundwater samples will be used to evaluate the effectiveness of the first round of chemical injections.

### **3.3 TASK 3: ADDITIONAL INJECTION OF CHEMICALS**

The activities of this task for each of the sub-areas are described below.

#### **3.3.1 Sub-area 2B**

Based on an evaluation of the data collected above, and assuming that the initial injection of oxidants will prove effective in reducing the concentrations, additional borings will be cored near MW-5I to inject the oxidants. The exact horizontal and vertical location of injections, the amount of chemical injection will depend on the results of Task 2.

After 30 days and 60 days, selected wells will be sampled to determine the effectiveness of the injections.

#### **3.3.2 Sub-area 6B**

Based on a careful evaluation of the data collected above, and assuming that the initial injection of oxidants is effective in reducing the concentrations, additional borings will be cored to inject the oxidants. The exact horizontal and vertical location of injections, the amount of chemical injection will depend on the results of Task 2.

After 30 days and 60 days, selected wells will be sampled to determine the effectiveness of the injections.

### **3.4 TASK 4: ANALYSIS OF DATA AND RECOMMENDATIONS**

At the end of 6 months of injections a comprehensive evaluation of all the data collected will be conducted with recommendations of any further actions.

### **3.5 TASK 5: REGULATORY INTERACTION**

Boeing intends to keep the regulators informed of the activities. This task will therefore include conference calls, face to face meetings, coordination of site visit by Agency personnel, etc. This communication will allow decisions to be made in the field as necessary to optimize the work.

## **SECTION 4.0**

### **SCHEDULE AND DELIVERABLES**

---

The section presents the proposed schedule and deliverables for the above activities.

#### **4.1 SCHEDULE**

The schedule to complete the above tasks is as follows:

- Tasks 1 will be started within 60 days of receipt of approval from the Agency personnel.
- Groundwater sampling activities in Task 2 will be started within 30 days of the initial injections.
- Additional injections may be initiated after the evaluation of the data collected.

#### **4.2 DELIVERABLES**

Following are the deliverables proposed for the interim remedial activities:

- At the completion of Task 4, a report documenting the procedures used and the results will be prepared. The report will present all the data, discuss the effectiveness of the injections, and present recommendation.

The report will include the following:

- Site plans showing vertical profile sample and injection boring locations;
- Tables with the results of groundwater samples collected;
- Laboratory reports and chain of custody records for all samples collected during the completion of Tasks 2 and 4;
- Documentation of off-site disposal of soil generated during Tasks 2 and 3;
- Boring logs and abandonment forms;
- Well construction forms;
- A discussion of the groundwater sample results;
- An evaluation of the effectiveness of the first round of chemical injections; and
- Recommendations to continue groundwater monitoring, conduct additional chemical injections, as appropriate.

## SECTION 5.0 REFERENCES

---

MACTEC, 2004a. *RCRA Facility Investigation Report for McDonnell Douglas, Hazelwood, Missouri*, December.

MACTEC, 20024b. *Enhanced Bioremediation Pilot Text Report for Boeing Tract 1, Hazelwood, Missouri*, February.

MACTEC, 2006. *Interim Measure Completion Report, Solid Waste Management Unit 17*.

Risk Assessment & Management Group, Inc. (RAM), 2004. *Risk-Based Corrective Action Report, Boeing Tract 1, St. Louis, Missouri*, September.

## **TABLES**

---

**Table 2-1**  
**Chlorinated Solvent Soil Concentrations for SWMU 17 Area (µg/kg)**  
**Boeing Tract 1, Hazelwood, Missouri**

Sample ID	Depth [ft bgs]	Sample Date	Tetrachloro ethene	Trichloroethene	cis-1,2- Dichloroethene	trans-1,2- Dichloroethene	Vinyl chloride
SB-2	11-12.5	2/4/1998	<b>1,100</b>	NA	<b>46</b>	<6.4	NA
SB-2	2.3-4.5	2/4/1998	<b>18,000</b>	NA	<6.5	<6.5	NA
SB-4	11.5-13.5	2/4/1998	<b>200,000</b>	NA	<b>760</b>	<7.2	NA
SB-4	14-16	2/4/1998	<b>240,000</b>	NA	<b>11,900</b>	<19,000	NA
SB-5	14-16	2/4/1998	<b>3,600</b>	NA	<b>280</b>	<38	NA
SB-5	5.5-7	2/4/1998	<b>35</b>	<6.5	<6.5	<6.5	<13
SB-18	15	12/5/2000	<b>9,300,000</b>	<b>14,000</b>	<b>68,000</b>	<5,000	<b>63</b>
MW-6S (SB-10)	4-5	4/20/1998	<6.3	<b>9.3</b>	<6.3	<6.3	<13
MW-6S (SB-10)	14-15	4/20/1998	<7.4	<b>28</b>	<7.4	<b>24</b>	<15
MW-7S (SB-14)	14	12/4/2000	NA	NA	NA	NA	NA
TP-1 (SB-1)	12-13	2/4/1998	<b>9,100</b>	NA	<b>22</b>	<6.4	NA
TP-1 (SB-1)	16-17	2/4/1998	<b>58,000</b>	NA	<b>88</b>	<6.8	NA
TP-2 (SB-3)	10.5-11.5	2/4/1998	<b>3,000</b>	NA	<b>24</b>	<6.7	NA
TP-4 (SB-7)	3.5-4.5	2/6/1998	<b>4,200</b>	<b>44</b>	<6.6	<6.6	<13
TP-4 (SB-7)	7.5-8.5	2/6/1998	<b>9.7</b>	<6.4	<6.4	<6.4	<13
TP-5 (SB-11)	5	12/4/2000	<b>440</b>	<b>1,900</b>	<b>57,000</b>	<b>7,200</b>	<b>560</b>
EXC-W-1	8	10/14/2005	<b>140</b>	<b>220</b>	<b>410</b>	<b>4</b>	<b>9.5</b>
EXC-W-2	7	11/9/2005	<b>7.5</b>	<b>3</b>	<b>31</b>	<b>1</b>	<b>0.65</b>
EXC-N-2	10	10/14/2005	<b>3,600</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>
EXC-N-3	6	10/14/2005	<b>15,000</b>	<b>400</b>	<b>110</b>	<b>110</b>	<b>110</b>
EXC-N-4	8	10/14/2005	<b>590</b>	<b>98</b>	<b>570</b>	<b>25</b>	<b>24.5</b>
EXC-N-05	7	11/9/2005	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0.65</b>
EXC-N-06	7	11/9/2005	<b>36</b>	<b>7</b>	<b>14</b>	<b>1</b>	<b>0.65</b>
EXC-N-07	6	11/14/2005	<b>8,700</b>	<b>160</b>	<b>260</b>	<b>1</b>	<b>7.7</b>
EXC-E-1	5	11/14/2005	<b>49</b>	<b>49</b>	<b>3,100</b>	<b>49</b>	<b>1,800</b>
EXC-S-1	2	11/14/2005	<b>1,350</b>	<b>1,350</b>	<b>135</b>	<b>1,350</b>	<b>1,350</b>
EXC-S-2	5	11/14/2005	<b>270</b>	<b>65</b>	<b>230</b>	<b>65</b>	<b>65</b>
EXC-S-3	6	11/14/2005	<b>25</b>	<b>25</b>	<b>1,300</b>	<b>25</b>	<b>840</b>
EXC-S-4	8	11/14/2005	<b>3,300</b>	<b>600</b>	<b>2,200</b>	<b>100</b>	<b>100</b>

Notes:

ug/kg - micrograms per kilogram

ft bgs: Feet below ground surface

Bold values are detected concentrations

<: less than the reporting limit concentration

NA: Not analyzed

**Table 2-2**  
**Chlorinated Solvent Groundwater Data for SWMU 17 Area**  
**Boeing Tract 1, Hazelwood, Missouri**

Sample ID	Collected Date	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride
<b>Current Wells</b>						
B48N1	11/11/2002	<5	<5	<5	<5	<5
	12/11/2002	3.4J3	<1	14	<1	<1
	3/21/2003	13	2.8	30	<1	<1
	6/27/2003	27	6.7	59	<1	<1
	11/20/2008	4.1J	<5	28.2	<5	<2
MW-5I	4/22/1998	<5	140,000	5,500	26	250
	2/22/2001	<500	270,000EF	3,500F	<500	<500
	2/22/2001 (DUP)	<1,000	230,000EF	4,600F	<1,000	<1,000
	7/27/2001	<2,000	160,000EFH	2,600FH	<2,000	<2,000
	10/26/2001	<5,000	150,000FH	<5,000	<5,000	<5,000
	12/18/2001	72F	60,000EF	2,100F	<50	170F
	3/7/2002	<1,000	100,000FH	1,900FH	<1,000	<1,000
	5/30/2002	<1,000	130,000EFH	3,500FH	<1,000	1,200FHJ4
	8/8/2002	<10,000	130,000FH	<10,000	<10,000	<10,000
	12/9/2002	<2,000	100,000	2,100	<2,000	<2,000
	3/19/2003	<500	120,000E	3,200	<500	<500
	6/27/2003	72	120,000	3,500	18	180
	6/27/2003 (DUP)	70	110,000	3,600	20	210E
	10/21/2005	200,000E	23,000	25,000E	<500	1,200
	11/20/2008	<250	89,000	4,430	<250	181
	4/29/2010	<10,000	223,000	9,600J	<10,000	<4,000
	11/1/2010	<10,000	263,000	14,500	<10,000	<4,000
	7/13/2011	< 10,000	250,000	13,600	< 10,000	< 4,000
	9/29/2011	< 1,000	214,000	12,700	< 4,000	1,000 J
MW-6S	4/21/1998	<5	370	4,000	55	940
	2/22/2001	<10	120F	32F	<10	53F
	7/27/2001	<1	<1	7.6H	<1	16HJ3
	12/19/2001	<1	<1	6H	<1	7.5H
	3/8/2002	<1	<1	12	<1	19
	5/30/2002	<5	<5	8.5FH	<5	9FH
	6/19/2003	<1	<1	14	1.8J4	29
	10/21/2005	3.1	<1	8	<1.0 J4, J3	17
	11/20/2008	<5	<5	3.8J	<5	<2
	4/29/2010	<5	<5	<5	<5	<2
	10/29/2010	<5	<5	<5	<5	<2
	7/13/2011	< 5	< 5	< 5	< 5	< 2
MW-8S	2/20/2001	4	<1	<1	<1	<1
	7/26/2001	3	<1	<1	<1	<1
	7/26/2001 (Dup)	2	<1	<1	<1	<1
	10/29/2001	6	<1	<1	<1	<1
	10/29/2001 (Dup)	5	<1	<1	<1	<1
	12/13/2001	2.8H	<1	<1	<1	<1
	12/13/2001 (Dup)	3.4H	<1	<1	<1	<1
	3/7/2002	<1	<1	<1	<1	<1
	3/7/2002 (Dup)	3	<1	<1	<1	<1

**Table 2-2**  
**Chlorinated Solvent Groundwater Data for SWMU 17 Area**  
**Boeing Tract 1, Hazelwood, Missouri**

Sample ID	Collected Date	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride
MW-8S	5/30/2002	5	1.6	1.4	<1	<1
	5/30/2002 (Dup)	4	<1	<1	<1	<1
	8/8/2002	3.3H	<1	<1	<1	<1
	8/8/2002 (Dup)	3	<1	<1	<1	<1
	12/9/2002	<1	<1	<1	<1	<1
	3/18/2003	2	<1	<1	<1	<1
	3/18/2003 (Dup)	2	<1	<1	<1	<1
	6/19/2003	32	1.6J4	2	<1	<1
	11/20/2008	1.9J	<5	<5	<5	<2
	4/29/2010	2J	<5	<5	<5	<2
	10/28/2010	2.3J	<5	<5	<5	<2
	7/13/2011	1.6 J	< 5	< 5	< 5	< 2
MW-8I	2/20/2001	<1	<1	<1	<1	<1
	7/26/2001	<1	<1	<1	<1	<1
	10/26/2001	<1	<2	<1	<1	<1
	12/18/2001	13H	<1	<1	<1	<1
	3/8/2002	<1	<1	<1	<1	<1
	5/30/2002	<1	<1	<1	<1	<1
	8/8/2002	<1	<1	<1	<1	<1
	12/9/2002	<1	8.9	<1	<1	<1
	3/18/2003	<1	<1	<1	<1	<1
	6/26/2003	<1	<1	<1	<1	<1
	11/20/2008	<5	<5	<5	<5	<2
	4/29/2010	<5	<5	<5	<5	<2
	10/28/2010	<5	<5	<5	<5	<2
	7/13/2011	< 5	< 5	< 5	< 5	< 2
MW-9S	2/21/2001	<1	<1	<1	<1	<1
	7/27/2001	<1	1.2H	<1	<1	<1
	7/27/2001 (Dup)	<1	1H	<1	<1	<1
	10/30/2001	<1	<1	1.3H	<1	<1
	10/30/2001 (Dup)	<1	<1	1.3H	<1	<1
	12/19/2001	<50	52F	<50	<50	<50
	12/19/2001 (Dup)	<1	<1	1.4H	<1	<1
	3/5/2002	<1	<1	<1	<1	<1
	5/30/2002	6,900EF	3,800EF	2,400F	<50	55F
	8/8/2002	<25	460F	<25	<25	<25
	12/11/2002	<1	<1	<1	<1	<1
	3/21/2003	<1	<1	<1	<1	<1
	3/21/2003 (Dup)	<1	<1	<1	<1	<1
	6/27/2003	<1	<1	<1	<1	<1
	11/20/2008	<5	<5	<5	<5	<2

**Table 2-2**  
**Chlorinated Solvent Groundwater Data for SWMU 17 Area**  
**Boeing Tract 1, Hazelwood, Missouri**

Sample ID	Collected Date	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride
MW-9S	3/8/2011	<5	<5	<5	<5	<2
MW-10S	2/20/2001	<1	<1	<1	<1	<1
	7/27/2001	<1	<1	<1	<1	<1
	10/29/2001	<1,000	<1,000	<1,000	<1,000	<1,000
	12/19/2001	<1	<1	<1	<1	<1
	3/5/2002	<5	<5	<5	<5	<5
	6/3/2002	<1	<1	<1	<1	<1
	6/17/2003	<1	<1	<1	<1	<1
	11/19/2008	<5	21.9	<5	<5	<2
MW-11S	2/20/2001	<1	<1	<1	<1	<1
	7/25/2001	29	8.9	19	<1	<1
	10/29/2001	<1	<1	<1	<1	<1
	12/17/2001	<1	<1	<1	<1	<1
	3/5/2002	<1	<1	<1	<1	<1
	6/3/2002	<1	<1	1.5H	<1	<1
	8/13/2002	<1	<1	<1	<1	<1
	12/5/2002	<1	<1	<1	<1	<1
	3/12/2003	<1	<1	<1	<1	<1
	6/17/2003	<1	<1	<1	<1	<1
	11/20/2008	<5	294	7.58	<5	<2
	4/29/2010 (SS)	<5	4.5J	<5	<5	<2
	4/29/2010 (LF)	<5	3.7J	<5	<5	<2
	10/29/2010 (SS)	<5	3.8J	<5	<5	<2
	10/29/2010 (LF)	<5	2.6J	<5	<5	<2
	7/14/2011	< 5	2.2 J	< 5	< 5	< 2
MW-11I	2/19/2001	<1	<1	<1	<1	<1
	7/26/2001	<1	<1	<1	<1	<1
	10/26/2001	<1	<2	<1	<1	<1
	12/17/2001	<1	<1	<1	<1	<1
	3/5/2002	<1	<1	<1	<1	<1
	6/3/2002	<1	<1	<1	<1	<1
	8/13/2002	<1	<1	<1	<1	<1
	8/13/2002 (Dup)	<1	<1	<1	<1	<1
	12/9/2002	<1	12	<1	<1	<1
	3/18/2003	<1	<1	<1	<1	<1
	3/18/2003 (Dup)	<1	<1	<1	<1	<1
	6/25/2003	<1	<1	<1	<1	<1
	6/25/2003 (Dup)	<1	<1	<1	<1	<1
	11/17/2008	<5	<5	<5	<5	<2
	4/28/2010 (SS)	<5	<5	<5	<5	<2
	4/28/2010 (LF)	<5	<5	<5	<5	<2

**Table 2-2**  
**Chlorinated Solvent Groundwater Data for SWMU 17 Area**  
**Boeing Tract 1, Hazelwood, Missouri**

Sample ID	Collected Date	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride
MW-11I	10/29/2010 (SS)	<5	<5	<5	<5	<2
	10/29/2010 (LF)	<5	<5	<5	<5	<2
	7/14/2011	< 5	< 5	< 5	< 5	< 2
MW-11D	2/19/2001	<1	<1	<1	<1	<1
	7/26/2001	<1	<1	<1	<1	<1
	10/26/2001	<1	17	<1	<1	<1
	12/17/2001	<1	1.3	<1	<1	<1
	3/5/2002	<1	1	<1	<1	<1
	6/3/2002	<1	5.2	<1	<1	<1
	6/3/2002 (Dup)	<1	4.6H	<1	<1	<1
	8/13/2002	<1	1.1	<1	<1	<1
	12/5/2002	<1	<1	<1	<1	<1
	3/12/2003	<1	<1	<1	<1	<1
	6/26/2003 (Dup)	<1	<1	<1	<1	<1
	11/18/2008	<5	<5	<5	<5	<2
	4/28/2010	<5	<5	<5	<5	<2
	10/29/2010	<5	<5	<5	<5	<2
	7/14/2011	< 5	< 5	< 5	< 5	< 2
SWMU17-OB-1	11/19/2008	<5	<5	<5	2.3J	<2
	4/29/2010	<5	<5	1.1J	<5	1.2J
	11/1/2010 (SS)	<5	<5	<5	<5	<2
	11/1/2010 (LF)	<5	<5	16.7	<5	24.7
	7/13/2011	< 5	< 5	5.3	< 5	3.3
TP-3	2/6/1998	<5	<5	<5	<5	<10
	2/23/2001	<100	<100	<100	<100	<100
	7/25/2001	<1	<1	<1	<1	<1
	10/29/2001	<1	<1	<1	<1	<1
	12/19/2001	<1	<1	<1	<1	<1
	3/5/2002	<1	<1	<1	<1	<1
	5/30/2002	7,100EF	4,800F	1,900F	<100	<100
	8/8/2002	<200	5,300F	<200	<200	<200
	12/9/2002	<1	<1	<1	<1	<1
	3/19/2003	<1	<1	<1	<1	<1
	6/27/2003	<1	<1	<1	<1	<1
	11/19/2008	<5	<5	<5	<5	<2
	7/12/2011	< 5	< 5	< 5	< 5	< 2
TP-4	2/9/1998	17,000	150	59	6.3	<10
	9-Feb-98 (Dup)	11,000	150	58	5.8	<10
	2/21/2001	79E	8.7	5.6	1.4	2
	7/26/2001	79EH	6.7H	8.6H	<1	1.3H
	10/30/2001	150EFH	33FH	100EFH	<2	5FH
	12/18/2001	35H	10H	14H	<1	5.2H
	3/8/2002	42J3	7.2	19	<1	6.4
	5/30/2002	320EFH	43FH	86FH	<5	6.2FHJ4

**Table 2-2**  
**Chlorinated Solvent Groundwater Data for SWMU 17 Area**  
**Boeing Tract 1, Hazelwood, Missouri**

Sample ID	Collected Date	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride
TP-4	6/26/2003	2,700E	160	190	1.1	5.3
	10/21/2005	2,100E	470E	1,200E	7.6	140
	11/19/2008	111	16.3	77.5	<5	3.87
	7/12/2011	85.9	23.7	109	1.8 J	4.5
	7/12/2011-Dup	115	27.3	115	1.8 J	4.7
TP-6	9/5/2001	<1,000	<1,000	<1,000	<1,000	<1,000
	12/18/2001	<100	2,900F	<100	<100	<100
	3/5/2002	<1	<1	<1	<1	<1
	3/5/2002 (Dup)	<1	<1	<1	<1	<1
	6/3/2002	<1	1.9H	<1	<1	<1
	8/13/2002	<1	<1	<1	<1	<1
	12/5/2002	<1	<1	<1	<1	<1
	3/18/2003	<1	<1	<1	<1	<1
	6/17/2003	<1	<1	<1	<1	<1
	11/19/2008	<5	<5	<5	<5	<2
	11/19/2008 (Dup)	<5	<5	<5	<5	<2
	7/12/2011	< 5	< 5	< 5	< 5	< 2
<b>Abandoned</b>						
B48I1	11/11/2002	<5	<5	<5	<5	<5
B48I2	11/11/2002	<5	<5	<5	<5	<5
B51I1	10/21/2005	4.1	1.5	160E	1.6	9.9
MW-7S	2/22/2001	130,000EF	10,000F	5,800F	<500	<500
	7/27/2001	66,000FH	<10,000	<10,000	<10,000	<10,000
	10/30/2001	490,000EFH	72,000FH	36,000FH	<2,000	<2,000
	12/13/2001	64,000EFH	5,800FH	9,400FH	<1,000	<1,000
	3/5/2002		5,500FH	4,100FH	<250	<250
	5/30/2002	65,000EF	5,100F	4,500F	<1,000	<1,000
	6/19/2003	89,000E	6,200	4,000	<500	<500
	10/21/2005	82,000E	4,700	4,800	<500J4J3	<500
SB18	12/5/2000	86,000	920J	2,400J	<2,500	<5,000
TP-1	2/5/1998	210,000	<25,000	97,000	150	<50,000
	2/23/2001	110,000EF	4,200F	58,000EF	<1,000	<1,000
TP-2	2/6/1998	45,000	6,000	6,900	30	<10
TP-2	2/23/2001	<1	<1	<1	<1	<1
	7/25/2001	12,000FHJ3	3,200FH	4,100FH	<250	<250
	10/30/2001	12,000FH	4,200FH	5,800FH	<1,000	<1,000
	12/18/2001	17,000EFH	3,800EFH	6,400EFH	<50	70FH
	3/8/2002	16,000FH	4,100FH	7,100FH	<1,000	<1,000
	5/30/2002	25,000EFH	5,600FH	11,000FH	<500	<500
	6/26/2003	25,000	6,000J4	8,700	<500	<500
	10/21/2005	24,000	3,800	5,500	<100	140
TP-5	12/4/2000	54,000	4,600	3,300	<2,500	<5,000

**Table 2-2**  
**Chlorinated Solvent Groundwater Data for SWMU 17 Area**  
**Boeing Tract 1, Hazelwood, Missouri**

Sample ID	Collected Date	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl chloride
TP-5	2/23/2001	44,000F	4,400F	5,700F	<2,500	<2,500
	7/27/2001	31,000FH	5,900FH	4,600FH	<1,000	<1,000
	10/30/2001	400,000EFH	84,000FH	67,000FH	<2,000	4,400FH
TP-7	9/5/2001	<5,000	<1,000	<1,000	<1,000	<3,000
TP-8	9/5/2001	<5	<1	200E	<1	<3
TP-9	9/5/2001	<2,500	<500	<500	<500	<1500
TP-10	9/5/2001	<1,200	<250	2,700FH	1,100FH	<750
TP-11	9/5/2001	4,300F	860FJ4	9,300F	<250	1,600F
TP-12	9/5/2001	<5	<1	<1	<1	<3
TP-13	9/5/2001	<5	<1	<1	<1	<3
TP-14	9/6/2001	<2,500	<500	<500	<500	<1,500
TP-15	9/6/2001	<25,000	<5,000	<5,000	<5,000	<15,000
TP-16	9/6/2001	<250	<50	<50	<50	<150
TP-17	9/6/2001	270F	15F	73F	<10	<10
	9/6/2001 (Dup)	190F	<10	66F	<10	<10
TP-18	9/6/2001	<1	<1	12	1.6	1
TP-19	9/6/2001	<5	<1	3.6	1.3	<3
	9/6/2001 (Dup)	<5	<1	3.5	1.4	<3
TP-20	10/15/2001	<5		<5	<5	< 5
	10/15/2001 (Dup)	<5	<1	<1	<1	<3
TP-21	10/15/2001	<5		155.6	<5	<5
	10/15/2001 (Dup)	<5		140.3	<5	<5
TP-22	10/15/2001	<5		581.2	139.9	<5
TP-23	10/15/2001	9.6		<5	<5	195.8
TP-24	10/15/2001	<5	<1	<1	<1	<3
	10/15/2001 (Dup)	<5	<1	<1	<1	<3
TP-25	10/15/2001	<5	<1	3.1	<1	<3

**Notes:**

All concentrations in ug/L (micrograms per liter).

E: GTL (EPA) - Greater than upper calibration limit: Actual value is known to be greater than the upper calibration range.

F: The original sample was diluted due to high amount of the analyte.

H: Re-analyzed.

J: analyte detected below reporting limit and estimated value shown.

J3: The associated batch QC was outside the established quality control range for precision.

J4: The associated batch QC was outside the established quality control range for accuracy.

S: spike recovery outside accepted recovery limits.

SS: Snap sample.

LF: Low-flow sample.

LF: Low-flow sample.

**Table 2-3**  
**Soil Data for Sub-area 6B (North)**  
**Boeing Tract 1, Hazelwood, Missouri**

Sample ID	Date	Depth (ft bgs)	Tetrachloro ethene	Trichloro ethene	1,2- Dichloro ethene (Total)	cis-1,2- Dichloro ethene	trans-1,2- Dichloro ethene	Vinyl chloride
MW-3-12	7/19/2000	12	< 6.3	1.9J	250			< 6.3
MW9S-12	9/18/2000	12	< 6.4	< 6.4		< 3.2	< 3.2	< 6.4
MW9S-18		18	< 5	< 5		< 5	< 5	< 5
MW9S-23		23	< 5	< 5		< 5	< 5	< 5
MW9S-37		37	< 5	< 5		< 5	< 5	< 5
MW9S-55		55	< 5	< 5		< 5	< 5	< 5
MW9S-68		68	< 5	< 5		< 5	< 5	< 5
MW9S-9		9	< 5	< 5		< 5	< 5	< 5
RC10-10	11/13/2000	10	< 6.2	< 6.2		< 3.1	< 3.1	< 6.2
RC11-15	12/7/2000	15	< 5	< 5		< 5	< 5	< 10
RC12-15		15	< 5	< 5		< 5	< 5	< 10
RC1-7	7/25/2000	7	< 6.5	3.9J	58			51
RC2-7		7	< 6.4	< 6.4	< 6.4			4.7J
RC3-5		5	< 7.9	98	240			< 7.9
RC3-5 DUP		5	< 6.9	120D	180D			< 6.9
RC4-10	9/18/2000	10	< 6.3	24		9.1	< 3.2	< 6.3
RC5-9		9	< 6.4	< 6.4		< 3.2	< 3.2	< 6.4
RC6-20		20	< 6.1	< 6.1		< 3.1	< 3.1	< 6.1
RC6-7		7	< 6.3	58		44	< 3.2	28
RC7-16		16		< 5		< 5	< 5	< 5
RC8-25		25	< 6.3	< 6.3		< 3.1	< 3.1	< 6.3
RC8-8		8					< 5	< 5
RC9-8	11/13/2000	8	< 6.4	< 6.4		< 3.2	< 3.2	< 6.4
REC-EXC-F-6	9/8/2005	6						4.6
REC-EXC-N-5		5						<1.2
REC-EXC-S-4		4						17
REC-EXC-E-2		2						<1.2
REC-EXC-W-5		5						36

Notes:

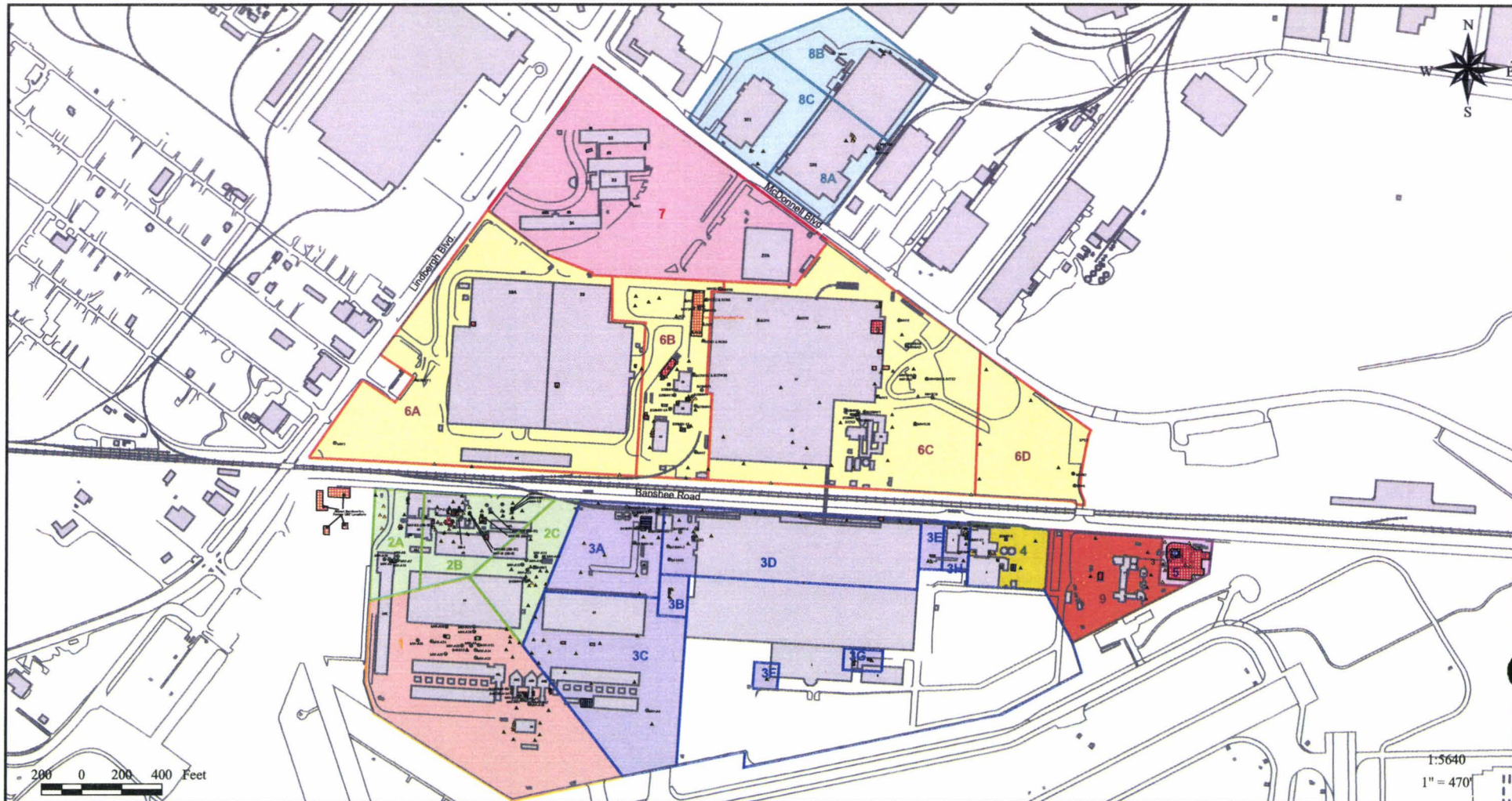
All concentrations in ug/kg (micrograms per kilogram)


















< Less than reporting limit shown

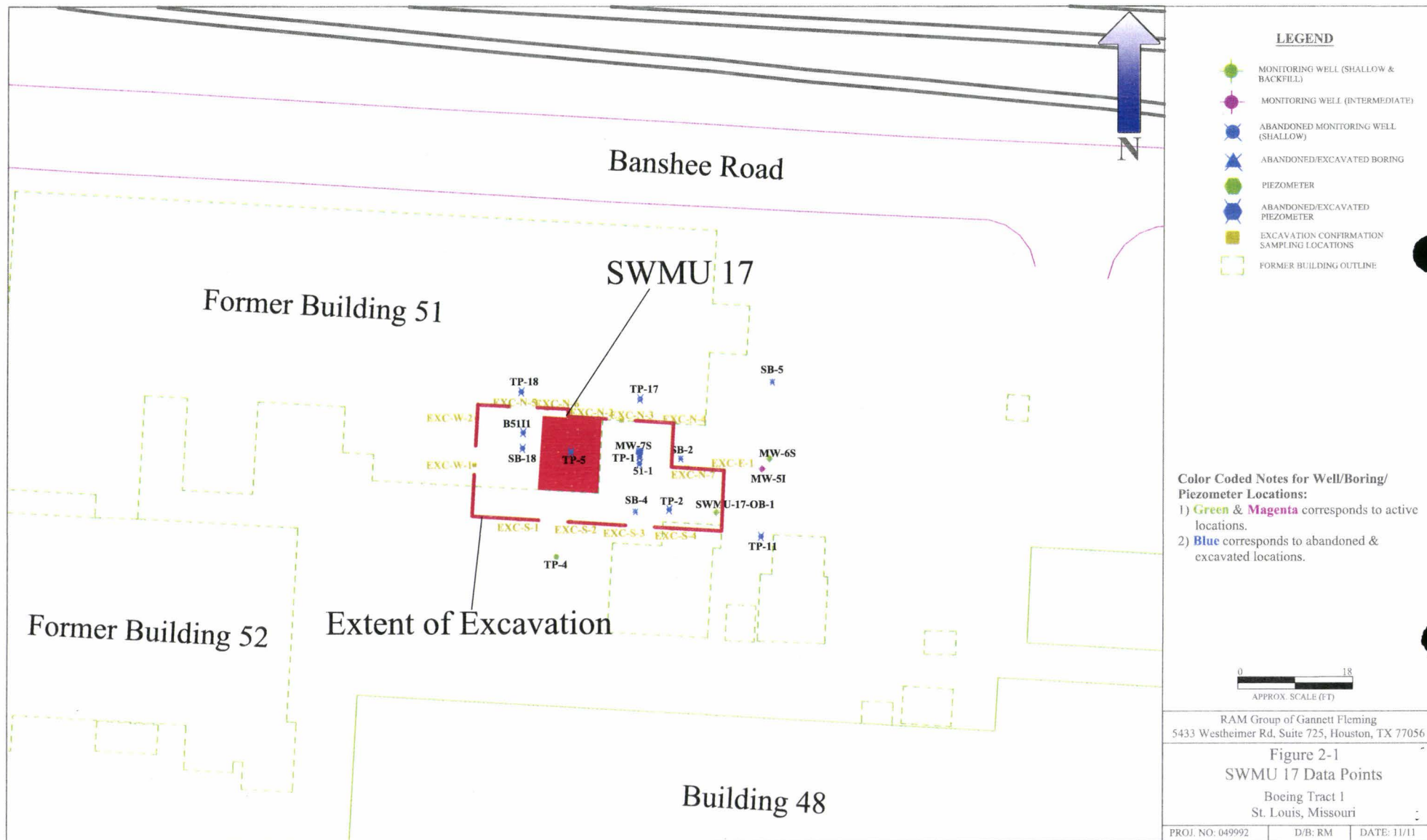
Blanks: Not analyzed

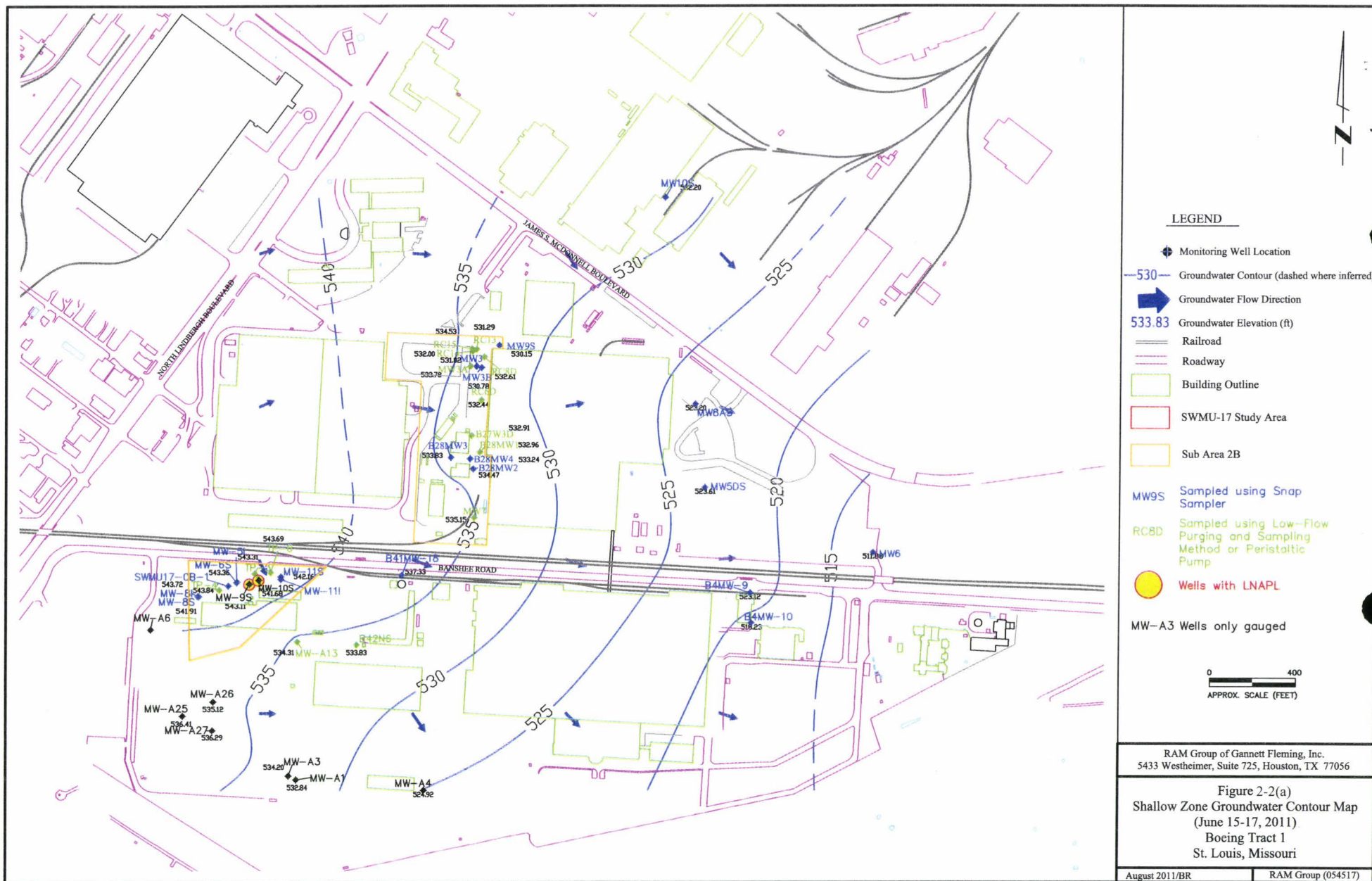
ft bgs: Feet below ground surface

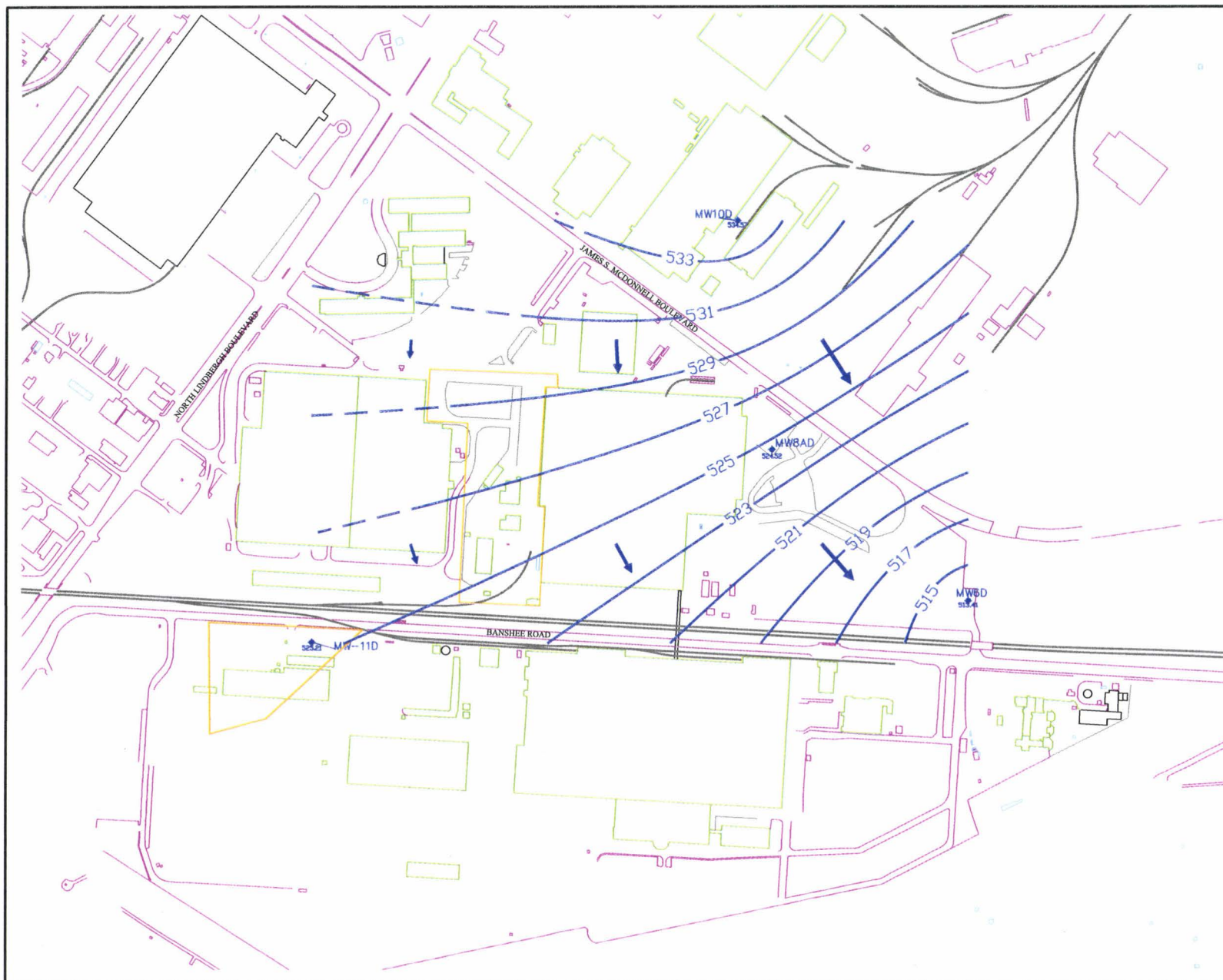
## **FIGURES**



Legend					Drawn by: BSM      Approved by:		Figure 1-1 Risk Assessment Exposure Area Map, Boeing Tract 1 (North and South)
	Abandoned Shallow Piezometer		RCRA Closure Shallow Boring		Other Area	Checked by:      Date: September 10, 2004	
	Abandoned Shallow Well		RFI Deep Boring/Temp. Piezometer		UST		
	Deep Piezometer		RFI Shallow Boring		SWMU	Risk Assessment & Management Group, Inc.	
	Deep Well		RFI Shallow Boring/Temp. Piezometer				
	Intermediate Well		Shallow Piezometer				
	Other Shallow Boring		Shallow Well				
	RFA Boring		UST Closure Sample				







# LEGEND

- Monitoring Well Location
- 531 Groundwater Contour (dashed where inferred)
- Groundwater Flow Direction
- 525.21 Groundwater elevation (ft)
- Railroad
- Roadway
- Building Outline

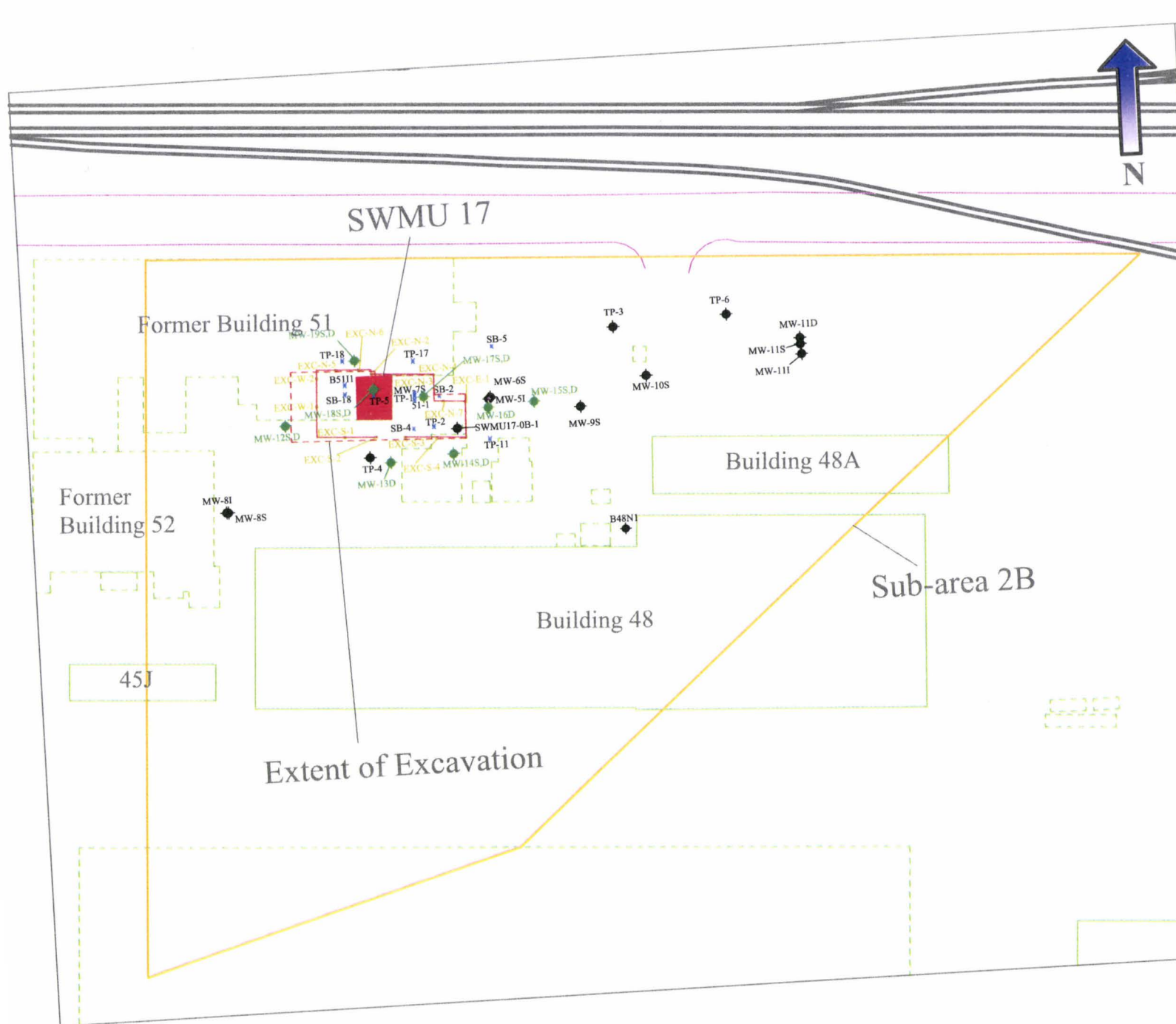
0 400  
APPROX. SCALE (FEET)

RAM Group of Gannett Fleming, Inc.  
5433 Westheimer, Suite 725, Houston, TX 77056

Figure 2-2(b)  
Deep Zone Groundwater Contour Map  
(June 15-17, 2011)  
Boeing Tract I  
St. Louis, Missouri

August 2011/BR

RAM Group (054517)



# **LEGEND**

- Monitoring Well/  
Boring/Piezometer
- Former Building  
Outline
- Current Building  
Outline
- ABANDONED MONITORING WELL  
(SHALLOW)
- ABANDONED/EXCAVATED BORING
- PIEZOMETER
- ABANDONED/EXCAVATED  
PIEZOMETER
- EXCAVATION CONFIRMATION  
SAMPLING LOCATIONS
- FORMER BUILDING OUTLINE

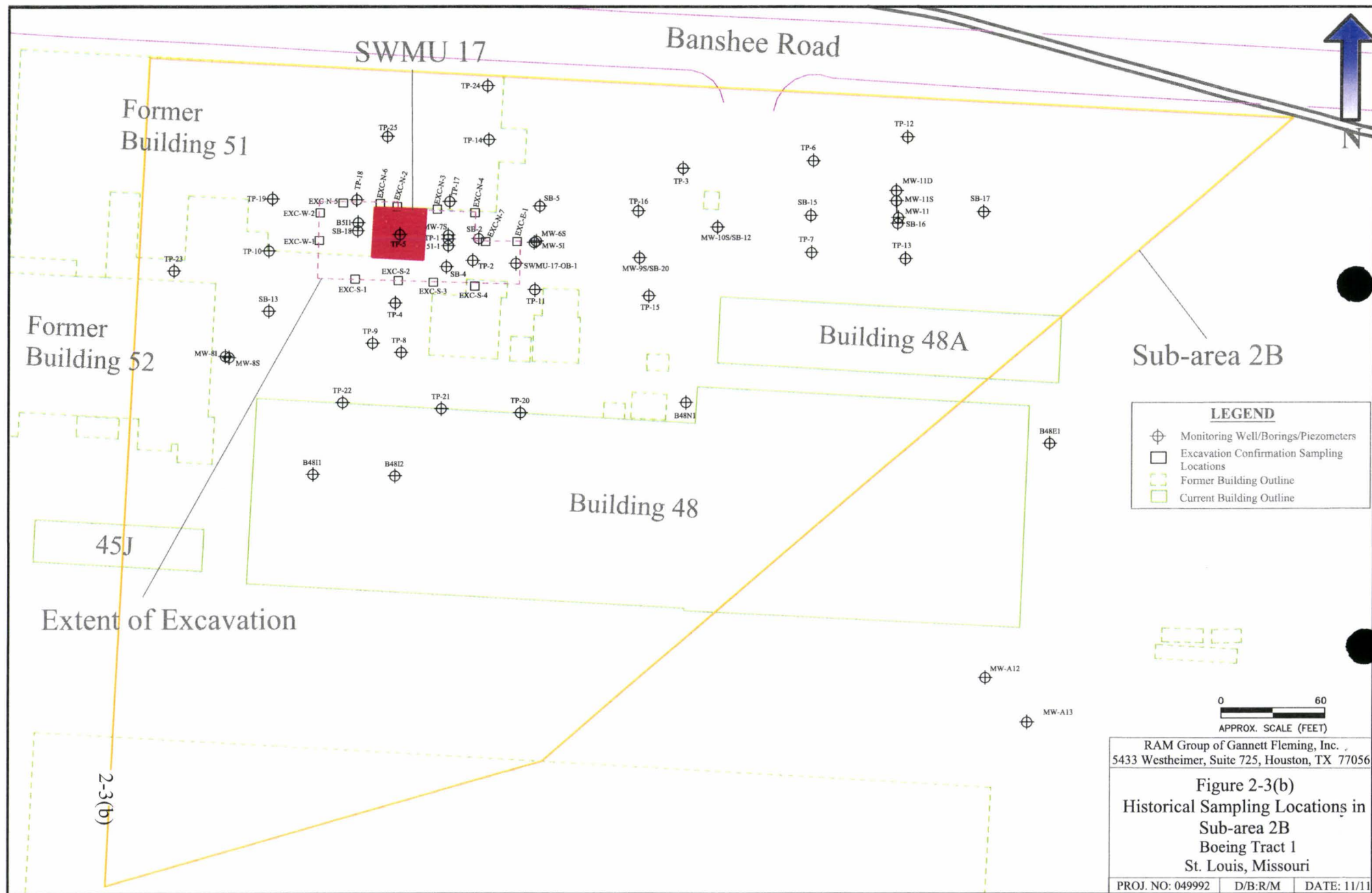
Wells in Blue corresponds to abandoned & excavated locations.

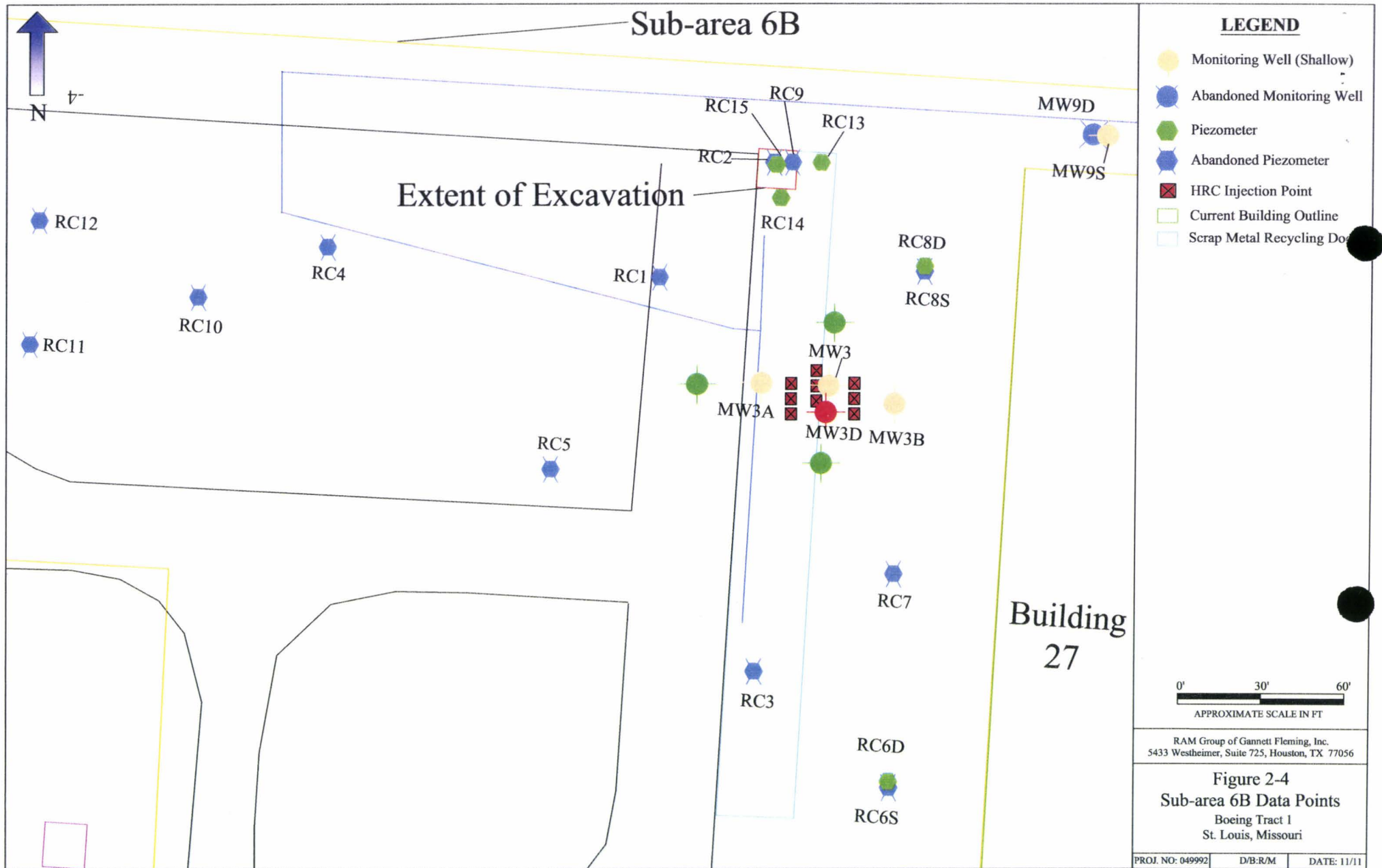
0 75  
APPROX. SCALE (FEET)

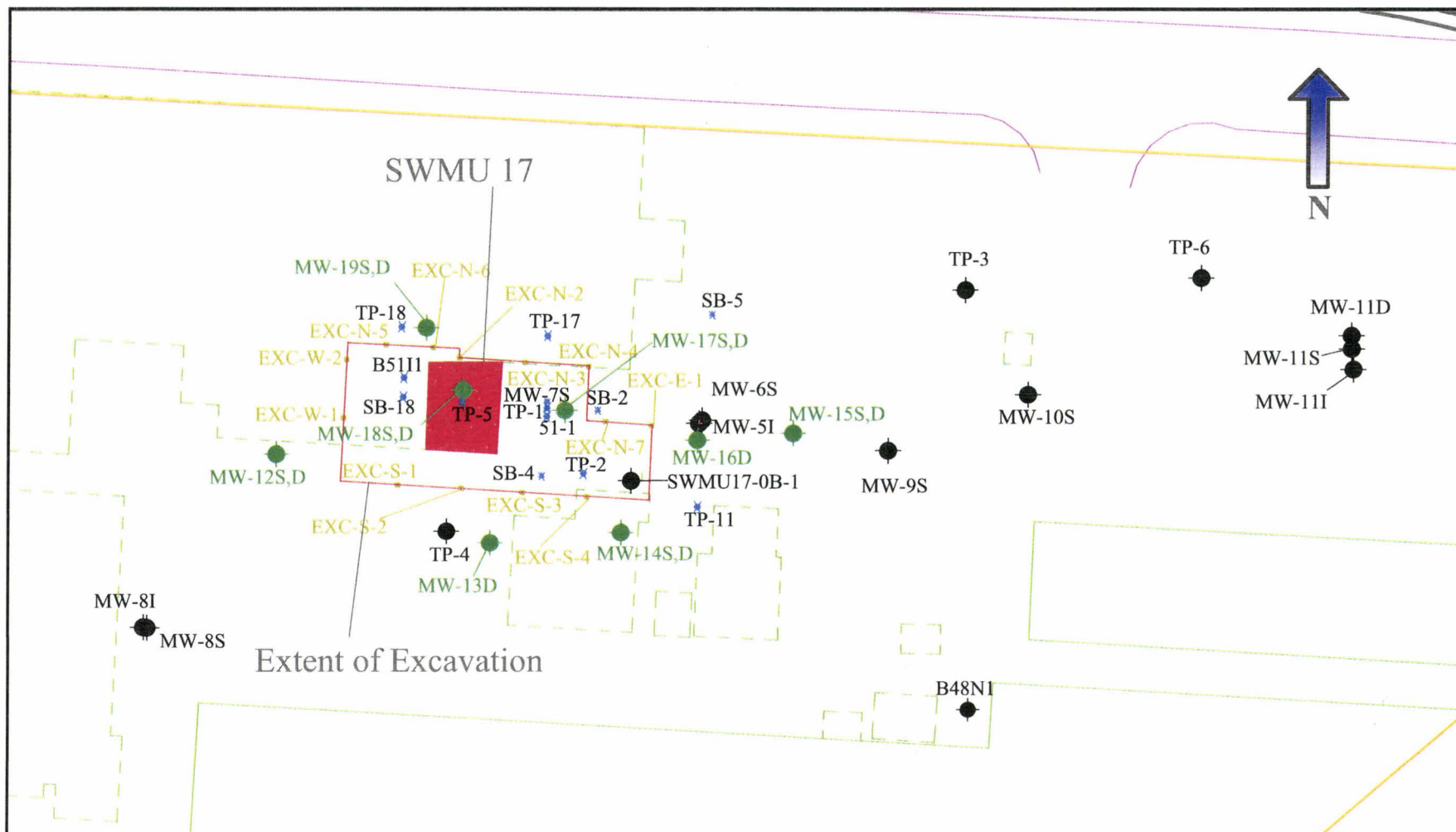
RAM Group of Gannett Fleming, Inc.  
5433 Westheimer, Suite 725, Houston, TX 77056

**Figure 2-3(a)**  
**Overview of Sub-area 2B**  
Boeing Tract 1  
St. Louis, Missouri

PROJ. NO: 049992 D/B:R/M DATE: 11/11







# **LEGEND**

- Proposed Monitoring Well
- Monitoring Well/ Boring/Piezometer
- Former Building Outline
- Current Building Outline
- ★ Abandoned Monitoring Well
- ★ Abandoned/Excavated Boring
- Piezometer
- ★ Abandoned/Excavated Piezometer
- Excavation Confirmation Sample

0 50  
APPROX. SCALE (FEET)

RAM Group of Gannett Fleming, Inc.  
5433 Westheimer, Suite 725, Houston, TX 77056

Figure 3-1  
Proposed Monitoring Well Locations in  
Sub-area 2B  
Boeing Tract 1  
Hazelwood, Missouri

PROJECT NO: 054517 | D/B:RM | DATE: 11/11

